SELF-REGULATED STAR-FORMATION IN GALAXIES

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In the chemodynamical models of galaxies the energy input from massive stars into the ambient medium results in a self-regulation of the star formation rate (SFR). A thorough analytical and numerical study of this model shows that there is always a strong and negative feed-back, and the SFR becomes almost independent of the assumed stellar birth function (SBF). The time-scale to reach this equilibrium is much shorter than the gas consumption time-scale, hence the models evolve along this solution for most of the time. This mechanism provides a physical explanation for a quadratic dependence of the SFR on gas density. For more details cf. Köppen et al. (1995), A&A **296**, 99 and in preparation.

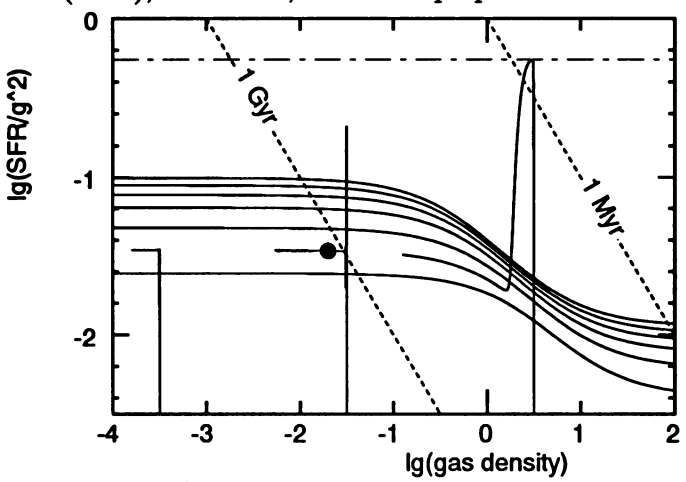

Figure 1. The ratio SFR/g^2 of the star-formation rate and gas density as a function of the gas density g (in $\mathrm{M}_\odot/\mathrm{pc}^3$): shown are the analytical equilibrium solutions for various values of the constant of proportionality in the SBF ($\log C = 9, 7, \ldots, -1$ from top to bottom). Also depicted are results from three numerical models with initial gas densities of $\log g = 0.5, -1.5$, and -3.5. Lines of equal star-formation timescale are short-dashed. The filled dot marks the equilibrium for our 'standard' value $C = 0.55$ at the density of the local interstellar medium ($n_{\mathrm{gas}} = 1\ \mathrm{cm}^{-3}$).